What is claimed is:

[Claim 1] A running tool adapted to releasably support a downhole tool comprising:

a mandrel having a bore and a locking cylinder movable axially over the mandrel and forming a piston annulus therebetween, a port being formed between the bore and the piston annulus, the locking cylinder having an uphole end;
a piston in the piston annulus and whose movement is axially delimited between an uphole stop on the mandrel and a downhole stop on the locking cylinder sleeve, the port being positioned axially between the uphole stop and the piston;
a latch cage positioned uphole of the locking cylinder and being movable axially on the mandrel between an engaged position and a disengaged position, the latch cage having two or more latch segments which are supported axially and movable radially so that when the latch cage is in the engaged position, the latch segments are supported in a radially extended position to engage with and axially support the downhole tool, and in the disengaged position, the latch segments are released to a radially recessed position to disengage from the downhole tool; and
two or more latch shoulders positioned downhole of the latch cage for axially supporting the latch cage in the engaged position, the latch shoulders being temporarily retained radially to the mandrel by the uphole end of the locking cylinder,
so that pressure applied at the port hydraulically drives the piston downhole to engage the downhole stop, moving the uphole end of the locking cylinder downhole to release the latch shoulders from the mandrel and permitting the latch cage to move axially to the disengaged position for releasing the latch segments from the downhole tool.

[Claim 2] The running tool of claim 1 further comprising radial profiles on the mandrel to form axially-spaced radially-extending ribs wherein when the latch cage is in the engaged position, the latch segments are aligned axially

with the radially-extending ribs to be supported in the radially extended position, and when the latch cage is in the disengaged position, the latch segments are misaligned from the radially-extending ribs to be released to the radially recessed position.

[Claim 3] The running tool of claim 1 further comprising radial profiles on the mandrel to form axially-spaced radially-extending ribs and radial recesses wherein when the latch cage is in the engaged position, the latch segments are aligned axially with the radially-extending ribs to be supported in the radially extended position, and when the latch cage is in the disengaged position, the latch segments are aligned with the radial recesses so as to be released to the radially recessed position.

[Claim 4] The running tool of claim 1,2 or 3 wherein the latch segments are normally biased radially inwardly to the mandrel.

[Claim 5] The running tool of any one of claims 1 - 4 further comprising a temporary axial restraint between the locking cylinder and the mandrel which is overcome by the pressure applied at the port.

[Claim 6] The running tool of any one of claims 1 - 5 further comprising a temporary axial restraint between the piston and the mandrel which is overcome by the piston movement.

[Claim 7] The running tool of any one of claims 1 - 6 further comprising a temporary axial restraint between the latch cage and the mandrel which is overcome by relative movement of the downhole tool and the mandrel.

[Claim 8] The running tool of any one of claims 1 - 7 further comprising:

an uphole drive housing fit about the mandrel and uphole from the latch cage wherein the drive housing is co-rotatable with the mandrel and has a drive face adapted for rotational drive coupling with the downhole tool, the mandrel being releasably supported on the drive housing; and
means for releasing the mandrel for axial movement through the drive housing and for manipulation through the latch cage so as to shift the latch cage and latch segments to the disengaged position.

[Claim 9] The running tool of claim 8 wherein the mandrel further comprises a non-circular interface which enables co-rotation of the drive housing with the mandrel and relative axial movement.

[Claim 10] The running tool of claim 8 or 9 wherein the drive housing is movable on the mandrel between an uphole position and a downhole position wherein the drive face is adapted for rotational drive coupling with the downhole tool.

[Claim 11] The running tool of claim 10 wherein drive housing is biased to the downhole position.

[Claim 12] The running tool of any one of claims 8 - 11 wherein uphole axial movement of the drive housing to the uphole position is limited by a clutch ring which is supported by the mandrel.

[Claim 13] The running tool of claim 12 wherein the clutch ring is releasably supported by the mandrel for enabling downhole movement of the mandrel relative to the downhole tool.

[Claim 14] The running tool of claim 13 wherein the clutch ring further comprises a radially-inward profile which engages a complementary profile on the mandrel, the inward profile being regularly and periodic circumferentially for enabling indexed and relative rotational actuation of the mandrel between an axially mandrel-supporting position of the clutch ring on the mandrel and an axially released position for enabling downhole movement of the mandrel relative to the clutch ring and downhole tool.

[Claim 15] The running tool of claim 14 further comprising a J-slot between the clutch ring and the mandrel and having:

a circumferential portion enabling limited indexed rotation so as to alternatively align the radially-inward profile and the complementary profile and misalign the radially-inward profile and the complementary profile; and an axial portion operative at the axially released position for enabling downhole movement of the mandrel relative to the clutch ring and downhole tool.

[Claim 16] The running tool of claim 8 further comprising a rotational clutch between the mandrel and the drive housing wherein a ratchet annulus is formed between the mandrel and the drive housing, the tool further comprising:

an external mandrel spline extending radially outwards from the mandrel into the ratchet annulus;
an internal housing spline extending radially inwards from the drive housing into the ratchet annulus; and
a barrel ratchet residing in the ratchet annulus and having internal teeth extending radially inward from a body and external teeth extending radially outward from the body, the body being flexible for enabling the internal teeth and external teeth to move radially in the annulus and alternate between locking the mandrel spline and housing spline for co-rotation in a driving direction and releasing the mandrel spline and housing spline in a ratcheting direction, wherein
the body of the barrel ratchet flexes to lock the mandrel spline and housing spline for co-rotation in a driving direction, and the barrel ratchet flexes to separate at least one of the barrel ratchet's internal or external teeth from the mandrel spine or housing spline respectively to release the mandrel spline and housing spline and enable relative rotation.

[Claim 17] The running tool of claim 16 wherein:

complementary driving faces are formed between each of the barrel ratchet's internal teeth and the mandrel spline and between the barrel ratchet's external teeth and the housing spline, the complementary driving faces engaging in the driving direction to lock the mandrel spline and housing spline for co-rotation in a driving direction, and
complementary ratcheting faces are formed between at least one of the barrel ratchet's internal teeth and the mandrel spline and between the barrel ratchet's external teeth and the housing spline so as to enable the barrel ratchet's body to flex in the ratcheting direction to separate at least one of the barrel ratchet's internal or external teeth from the mandrel spine or housing

spline respectively to release the mandrel spline and housing spline and enable relative rotation.

[Claim 18] The running tool of claim 16 of 17 wherein the body of the barrel ratchet further comprises a cylindrical body having a plurality of axially extending, circumferentially spaced slots about its circumference, each slot extending from alternating first and second ends of the body and ending adjacent alternating second and first ends of the body respectively.

[Claim 19] The running tool of claim 18 wherein a first set of slots extend axially from a first end to end adjacent a second end and a second set of slots extend axially from the second end to end adjacent the first end, the slots of the first and second sets of slots alternating for forming alternating flexible internal teeth and flexible external teeth.

[Claim 20] A latch for releasably supporting a mandrel in a tubular portion of a downhole tool comprising:

a latch cage movable axially over the mandrel between an engaged position and a disengaged position; and
two or more latch segments which are supported axially and movable radially by the latch cage so that when the latch cage is in the engaged position, the latch segments are supported in a radially extended position to engage with and axially support the downhole tool, and in the disengaged position, the latch segments are released to a radially recessed position to disengage from the downhole tool; and
means for releasably supporting the latch cage in the engaged position.

[Claim 21] The latch of claim 20 wherein the means for releasably supporting the latch cage further comprises:

a locking cylinder movable axially over the mandrel and forming a piston annulus therebetween, a port being formed between the bore and the piston annulus, the locking cylinder having an uphole end;
a piston in the piston annulus and whose movement is axially delimited between an uphole stop on the mandrel and a downhole stop on the locking cylinder sleeve, the port being positioned axially between the uphole stop and the piston;
two or more latch shoulders positioned downhole of the latch cage for axially supporting the latch cage in the engaged position, the latch shoulders being temporarily retained radially to the mandrel by the uphole end of the locking cylinder,
so that pressure applied at the port hydraulically drives the piston downhole to engage the downhole stop, moving the uphole end of the locking cylinder downhole to release the latch shoulders from the mandrel and permitting the latch cage to move axially to the disengaged position for releasing the latch segments from the downhole tool.

[Claim 22] The latch of claim 21 further comprising radial profiles on the mandrel to form axially-spaced radially-extending ribs wherein when the latch cage is in the engaged position, the latch segments are aligned axially with the radially-extending ribs to be supported in the radially extended position, and when the latch cage is in the disengaged position, the latch segments are misaligned from the radially-extending ribs to be released to the radially recessed position.

[Claim 23] The latch of claim 21 further comprising radial profiles on the mandrel to form axially-spaced radially-extending ribs and radial recesses wherein when the latch cage is in the engaged position, the latch segments are aligned axially with the radially-extending ribs to be supported in the radially extended position, and when the latch cage is in the disengaged position, the latch segments are aligned with the radial recesses so as to be released to the radially recessed position.

[Claim 24] The latch of any one of claims 21 - 23 wherein the latch segments are normally biased radially inwardly to the mandrel.

[Claim 25] The latch of any one of claims 21 - 24 further comprising a temporary axial restraint between the locking cylinder and the mandrel which is overcome by the pressure applied at the port.

[Claim 26] The latch of any one of claims 21 - 25 further comprising a temporary axial restraint between the piston and the mandrel which is overcome by the piston movement.

[Claim 27] The latch of any one of claims 21 - 26 further comprising a temporary axial restraint between the latch cage and the mandrel which is overcome by relative movement of the downhole tool and the mandrel.

[Claim 28] A latch for releasably supporting a mandrel in a tubular portion of a downhole tool comprising:

a locking cylinder movable axially over the mandrel and forming a piston annulus therebetween, a port being formed between the bore and the piston annulus, the locking cylinder having an uphole end;
a piston in the piston annulus and whose movement is axially delimited between an uphole stop on the mandrel and a downhole stop on the locking cylinder, the port being positioned axially between the uphole stop and the piston;
a latch cage positioned uphole of the locking cylinder and being movable axially on the mandrel between an engaged position and a disengaged position, the latch cage having two or more latch segments which are supported axially and movable radially so that when the latch cage is in the engaged position, the latch segments are supported in a radially extended position to engage with and axially support the downhole tool, and in the disengaged position, the latch segments are released to a radially recessed position to disengage from the downhole tool; and
two or more latch shoulders positioned downhole of the latch cage for axially supporting the latch cage in the engaged position, the latch shoulders being temporarily retained radially to the mandrel by the uphole end of the locking cylinder,
so that pressure applied at the port hydraulically drives the piston downhole to engage the downhole stop, moving the uphole end of the locking cylinder downhole to release the latch shoulders from the mandrel and permitting the latch cage to move axially to the disengaged position for releasing the latch segments from the downhole tool.

[Claim 29] The latch of claim 28 wherein the latch segments are normally biased radially inwardly to the mandrel.

[Claim 30] The latch of claim 28 or 29 further comprising a temporary axial restraint between the locking cylinder and the mandrel which is overcome by the pressure applied at the port.

[Claim 31] The latch of any one of claims 28 - 30 further comprising a temporary axial restraint between the piston and the mandrel which is overcome by the piston movement.

[Claim 32] The latch of any one of claims 28 - 31 further comprising a temporary axial restraint between the latch cage and the mandrel which is overcome by relative movement of the downhole tool and the mandrel.

[Claim 33] A ratchet comprising:

a mandrel and a housing forming an annulus therebetween, the mandrel having an external spline extending into the annulus and the housing having an internal spline extending into the annulus; and
a barrel ratchet residing in the ratchet annulus and having internal teeth extending radially inward from a body and external teeth extending radially outward from the body, the body being flexible for enabling the internal teeth and external teeth to move radially in the annulus and alternate between locking the mandrel spline and housing spline for co-rotation in a driving direction and releasing the mandrel spline and housing spline in a ratcheting direction, wherein
the body of the barrel ratchet flexes to lock the mandrel spline and housing spline for co-rotation in a driving direction, and the barrel ratchet's flexes to separate at least one of the barrel ratchet's internal or external teeth from the mandrel spine or housing spline respectively to release the mandrel spline and housing spline and enable relative rotation.

[Claim 34] The ratchet of claim 33 wherein:

complementary driving faces are formed between each of the barrel ratchet's internal teeth and the mandrel spline and between the barrel ratchet's external teeth and the housing spline, the complementary driving faces engaging in the driving direction to lock the mandrel spline and housing spline for co-rotation in a driving direction, and
complementary ratcheting faces are formed between at least one of the barrel ratchet's internal teeth and the mandrel spline and between the barrel ratchet's external teeth and the housing spline so as to enable the barrel ratchet's body to flex in the ratcheting direction to separate at least one of the barrel ratchet's internal or external teeth from the mandrel spine or housing spline respectively to release the mandrel spline and housing spline and enable relative rotation.

[Claim 35] The ratchet of claim 33 or 34 wherein the body of the barrel ratchet further comprises a cylindrical body having a plurality of axially extending, circumferentially spaced slots about its circumference, each slot extending from alternating first and second ends of the body and ending adjacent alternating second and first ends of the body respectively.

[Claim 36] The ratchet of claim 35 wherein a first set of slots extend axially from a first end to end adjacent a second end and a second set of slots extend axially from the second end to end adjacent the first end, the slots of the first and second sets of slots alternating for forming alternating flexible internal teeth and flexible external teeth.